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ABSTRACT

Despite the popularity of schedule modifications as a cost-effective reform to improve student outcomes, little empirical research on the consequences of alternative schedules has been conducted. The literature has been dominated by anecdotal reports. Even when empirical evidence is examined, causal comparisons of school outcomes between schedules must be interpreted with caution, due to the number of confounding variables. A review of the literature shows positive and negative outcomes that depend on how teachers make use of schedule changes. The study described in this report compared the outcomes of achievement attained by high school students educated in block, semester, and trimester schedules in 1 urban district during 4 years. The study examined student annual grade-point averages, scores on the Stanford Achievement Test 9, credits attempted and earned, and absentee rates. Descriptive and inferential statistics were utilized. Analysis of covariance was the primary tool to test for mean differences between student outcomes. The study controlled for race or ethnicity, limited English proficiency, free or reduced lunch, gender, and special education. Students in a semester schedule had higher grade-point averages (adjusted mean 2.35) than those in block schedules (2.29) or trimester (2.22). Although the differences in this study were significant, questions regarding their practical significance should be raised. Weick's social-psychological model of organizing suggests that a school's normative structure is only loosely coupled with its behavioral structure. In short, structure may change without affecting behavior, and vice versa. This study reaffirms the importance of educators' thinking beyond structural changes. While structural changes may be necessary for student improvements, they are not sufficient. Educators must also consider the necessity of curriculum and policy alignment, professional development, changes in power relationships, and normative changes regarding schooling. (Contains 41 references.) (Author/RKJ)

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Differences in Student Outcomes between Block, Semester, and Trimester Schedules

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Abstract

This paper investigates differences in student outcomes between the block, semester, and trimester schedules in one urban district. Students within a semester schedule maintained a higher annual grade point average than students on the A/B block or trimester schedule. In the district studied, all students are required to earn the same minimum number of credits to graduate. However, students in the block and trimester schedules have the opportunity to earn more credits each year than students under the semester schedule. Consequently, students in the semester schedule must pass a higher percentage of courses to graduate on time, which results in higher GPAs. Second, students within the semester earned significantly higher SAT9 Total Math scores than students on block and trimester schedules, while students on block and trimester schedules had significantly higher SAT9 Total Science. One potential explanation is that students benefit from math courses that are sequential and meet daily for shorter periods of time. On the other hand, students in science courses may profit from longer periods, allowing in-depth and hands-on lab experiences. Third, no significant differences were found between core credits attempted—possibly attributed to the state and district's uniform graduation requirements. However, students in the A/B block earned core credits at a lower percentage compared to the trimester and semester schedules. Furthermore, students within the A/B block and the trimester attempt significantly more electives than students in the semester schedule, although students in the semester complete elective credits at a higher percentage. Because students within the A/B block and trimester have the opportunity to attempt and earn more credits, they may be less motivated to pass courses since they can fail a higher percentage of classes and still graduate on time. Finally, the percent of total days absent within the semester and A/B block was significantly lower than students within the trimester.

Introduction

For decades, school reformers have searched for cost effective reform tools to improve student outcomes. Restructuring school time has been one common approach. This strategy gained momentum as a catalyst for change in secondary schools in reaction to perceived ineffective and inefficient time models that purportedly lead to declines in student achievement (Canady & Rettig, 1995a). Despite the popularity of schedule modifications, little empirical research on the consequences of alternative schedules has been conducted. On the contrary, the literature is dominated by anecdotal reports of benefits and problems.

Given the paucity of research on the educational consequences of various school schedules, this study will compare the outcomes of high school students educated in a block, semester, and trimester schedule in one urban district. The paper begins with a review of the literature outlining the theoretical cases for and against alternative schedules, integrating empirical studies that have been conducted to test these claims. Next, the results from the urban district in this study are presented. The paper concludes with a discussion of these results in relation to the anecdotal and theoretical claims made regarding alternative schedules.

The Case for Alternative Schedules

Literature on the potential benefits and limitations of alternative scheduling models is voluminous. However, most of the claims made are not based on data. Moreover, even when empirical evidence is examined, causal comparisons of school outcomes between different schedules must be interpreted with caution due to the number of confounding variables that interact with the outcome measures. In other words, schedules are facilitating structures.

Curriculum and Instruction

With the above caveat in mind, structural adjustments have been sought to liberate teaching and learning by choosing scheduling formats that enable teachers to focus on individual student needs. Kovalik (1994) suggests that the flexibility of alternative scheduling formats addresses one of the fundamental suppositions of teaching and learning—collectively, we do not learn the same way or at the same pace. Correspondingly, alternative schedules utilizing longer classes purportedly promote increased individualized instruction since teachers may concentrate on one group of students for a longer period (Shortt & Thayer 1999; Carroll, 1994a; Deuel, 1999; Salvaterra & Adams, 1996; Staunton, 1997, Vars, 1993). Teacher-student contact has also been found to increase due to the number of class preparations decreasing (Ballinger, 1995; Buckman, King, & Ryan, 1995; Cawelti, 1994; O'Neil, 1995). Teachers gain additional time increasing the potential to implement creative and diverse student-centered instructional practices or pedagogical techniques and flexible assessment/evaluative strategies that could otherwise not be utilized under traditional schedules (Adams & Salvaterra, 1998; Cawalti, 1994; Carroll, 1994a; Deuel, 1999; Schoenstein, 1995). Consistent with these claims, some researchers have found that teachers alter their instruction based on individual student needs after switching to longer class periods (Kruse & Kruse, 1995; Adams & Salvaterra, 1998). Furthermore, O'Neil (1995) and Deuel (1999) concluded that teachers on block schedules describe their instructional practices as more effective compared to their instruction under traditional structures.

In addition to being more individualized, extended class periods are purported to lead to more innovative and hands-on instruction (Duel, 1999) by reducing curricular fragmentation and facilitating the use of modified teaching and learning activities (Canady & Rettig, 1993; Canady & Rettig, 1995a). As touched on above, Staunton & Adams (1997) report that non-traditional

schedules provide occasions to experiment with new instructional approaches. They found that teachers utilize more computer and science lab projects after implementing a non-traditional schedule (Salvaterra & Adams, 1995). Likewise, O'Neil (1995) described how non-traditional schedules reduce teacher stress by allowing teachers to concentrate on fewer classes and by creating formats in which teachers may pursue creative instructional methods that fail to conform to traditional schedules. Concentration on fewer classes also increases planning time (Ballinger, 1995; Buckman, King, & Ryan, 1995; Cawelti, 1994; O'Neil, 1995) and participation with site-based committees, students, and parents (Bowman, 1998). Time allocated to such planning and collaboration may enable teachers to develop more innovative and individualized instruction.

Student Achievement and Attitudes

The above improvements in curriculum and instruction are predicted to lead to gains in student learning. Edwards (1995a) discovered that students on a 4X4 block schedule have approximately double the time to master information compared to students on a traditional schedule. This finding is congruent with Huff's (1995) claim that longer class periods increase depth of learning and mastery. Likewise, Fogarty (1996), O'Neil (1995), Queen, Algozzine, and Eaddy (1998), and Reither (1999) suggest that longer instructional periods may increase in-depth learning through learner-centered approaches, like cooperative learning, student-directed projects, and group work. It is also suggested that fewer courses allow more time to master subjects, while the longer blocks create longer uninterrupted instructional time, which may lead to more time on task, increased hands-on, lab, and interactive activities, and more personalized instruction (Deuel, 1999). Voelkl (1995) reported that time periods favorable to increasing student participation are shown to increase student achievement. Students purport that as a result

of using more diverse instructional practices learning is more meaningful (Adams & Salvaterra, 1998).

Several studies have focussed on student achievement in alternative schedules, particularly within the block. Edwards (1995a) found that after block scheduling had been implemented, the number of students earning an "A" increased from 21 to 28 percent. Similarly, Deuel (1999) reported that students under the block earned more A's, fewer C's, D's, and F's, and higher grades in advanced mathematics courses than students in traditional schedules. Salvaterra and Adams (1995) found that student GPAs increased while discipline occurrences decreased as a possible result of implementing a non-traditional schedule. One high school from Dow and George's (1998) study reported that after moving to a non-traditional schedule they saw a 33 percent increase in the number of honor roll students, an overall increase in GPA for all students, and 50 percent fewer discipline referrals from the prior year (traditional schedule). Similarly, Reither (1999) reported a 50 percent increase in the number of students under the block placed on the honor roll. Non-traditional scheduling is also reported to increase student attendance, graduation rates, the number of students attending four-year academic institutes upon graduation, the number of course credits completed, and decrease failure rates (Edwards, 1993 and 1995b; O'Neil, 1995).

In reference to test scores, Shortt and Thayer (1999) discovered that the AB and 4X4 schools outperformed the single-period schools on math and reading test scores from Virginia's use of the Iowa Test of Basic Skills, the 11th grade norm-referenced test in 1995-96, and the Stanford Achievement Test 9th edition used in 1996-97. Edwards (1995a), studying a district, while block scheduling was being implemented, reported the number of students scoring fours and fives on the Advanced Placement (AP) exams increased from 44 to 58 percent. Edwards

(1995a) also discovered that students school-wide completed 26 percent more classes than in the previous year. He purported that large increases in the number of core classes completed may affect standardized scores within the next few years, although no follow-up tests have been reported.

Knight, De Leon, and Smith (1999) compared students' academic performance, indicated by GPA, course grade, AP test scores, and final exam scores, between block and traditional schedules and found that students on the block performed significantly better than students in traditional settings, even after controlling for class size. On the contrary, they also reported that students in block schedule AP classes failed to take the AP exam as frequently as their counterparts taught by the same teacher in traditional AP classes, and when they did take the exams, they did not perform as well as those in traditional classes. Hence, it may be advantageous to create modified AP schedules to remedy the lag time between ending class and exam date. Similarly, Salvaterra and Adams (1995) found that after implementing a block schedule average scores on Advanced Placement exams decreased, possibly as a result of the lapse in time between taking the AP course during fall and the exam in spring. There were no significant differences in ACT and SAT scores.

Despite the lack of clear evidence of gains on standardized test scores, students in alternative schedules tend to report more favorable attitudes regarding schooling than their counterparts. For example, Knight, De Leon, and Smith (1999) found that students under the block reported significantly better study habits, greater involvement in class activities, and more positive learning environments than students on the traditional schedule. Likewise, O'Neil (1995) found that students on the block had increased levels of cognitive engagement and more positive attitudes toward school.

Advocates of alternative schedules posit that these formats may also reduce student stress by allowing students to concentrate on fewer classes, tests, teachers, teaching styles, teacher personalities, behavioral expectations, and assignments (Canady, 1989; Canady & Rettig, 1995b). Furthermore, Canady & Hotchkiss (1989) add that schedules, which enable students to center their attention around a few courses during one semester instead of the entire year, promote attendance and acceptable behavior during the second semester. Their reasoning is that students with no chance of passing the course after the first semester usually resort to either missing class or misbehaving during class during the second semester. Even when students are absent, Deuel (1999) suggests that there are fewer classes to make-up.

School Climate

Proponents contend that alternative schedules also improve school climate. First, alternative schedules are expected to personalize and improve school climate since students are able to spend longer periods with one teacher (Carroll, 1994b; Kruse & Kruse, 1995; Adams & Salvaterra, 1998), thereby enhancing personal relationships and school community. Moreover, additional planning time allows opportunities for teachers to collaborate more and practice preventive discipline as a replacement for more punitive measures (Deuel, 1999).

Educators describe other rationales for how alternative schedules improve school climate. Rettig & Canady (1997) claim that as a result of fewer classes, schools are cleaner because of reduced hallway transitions. This reduced number of passing periods is also predicted to lead to fewer discipline problems, which are frequent during times of class transitions. Deuel (1999) notes that fewer classes means reduced hallway traffic, fewer classes to skip, reduced tardiness, and fewer fights. Rettig & Canady (1997) also note that teachers involved with disciplining students under alternative schedules receive additional time to cool down over the day(s) until

the next class meeting. Lastly, Canady & Rettig (1995b) state that traditional schedules limiting instructional time and pressure to cover the curriculum influence teachers to issue harsher penalties when students misbehave. It is contended that since teachers know they will have students for a longer timeframe, they are encouraged to utilize student discipline strategies, which would keep misbehaving students in class and learning.

Other Benefits

Finally, advocates of alternative schedules note other general advantages for students and teachers. First, teachers and staff experience reduced record keeping given that there are fewer classes each day. Second, under alternative schedules, teachers and students usually have at least two opportunities to start afresh during the school year. Non-traditional schedules also increase students' opportunities to retake failed courses during the second semester, as well as allowing for acceleration. Specifically, Rettig & Canady (1997) reported that non-traditional schedules increase opportunities for early graduation, repeat coursework, specialized courses, concurrent enrollment, college prep courses, and school-to-work courses. Finally, by facilitating teaming and common planning periods, alternative schedules may reduce teacher isolation (Reither, 1999).

The Case Against Alternative Schedules

For every benefit of an alternative schedule, opponents note potential problems. Rettig and Canady (1997) cite among the worries of alternative schedules: learning retention; sequencing of foreign languages, math, fine arts, advanced placement, and special education courses; and larger class sizes. Critics list a multitude of other potential problems with alternative schedules: students' maturity level and ability to profit from an alternative format; converting student transfer credit from other schedules; maintaining students attention for longer

periods of time; adapting instructional strategies to match longer blocks of time; covering the same amount of material (depth vs. breadth); dumbing-down the curriculum since less time is spent per course although additional courses beyond offerings under a traditional schedule are available; requiring additional review time (e.g.. when classes on Thursday do not meet until the following Monday); and additional implementation costs. Furthermore, additional instructional time may be lost if teachers use the same instructional strategies and fill the extra time with "homework."

Despite advocate's claims regarding improved student outcomes resulting from restructured school schedules, critics charge that structural changes alone are insufficient for real reform. Elmore (1995) found that structural change does not necessarily lead to changes in student performance. Observations of teaching practices supported static classroom environments. Student outcomes failed to improve due to perpetual normative classroom activities like: teachers answering their own questions; classrooms arranged in teacher-centered designs; and activities centered on rote learning. Similarly, other findings have shown that while it may, diverse and innovative pedagogical instruction does not necessarily occur in longer class periods (O'Neil, 1995). Kramer (1996) reported that teacher effectiveness regarding instructional methods increased only when teachers acquired sufficient planning time and professional development. Moreover, non-traditional scheduling was reported successful only when lucid and measurable instructional goals were expressed, meaningful staff development linked to those goals was provided, and expectations that teachers would change their instructional processes were articulated (Shortt & Thayer, 1997). Others discuss finding negative effects or no effects of block scheduling on student achievement (Lockwood, 1995;

Wronkovich, Hess, & Robinson, 1997). In short, while implementing non-traditional schedules alter the structure of time, lack of modifying the use of time leads to little, if any, improvements.

Purpose of the Study

Support for alternative scheduling is related to the collective improvements in school climate and outcomes (Rettig & Canady, 1997). Moreover, Salvaterra and Adams (1996) proposed that teachers' perceptions of the benefits or problems associated with the change may drive the future success of alternative scheduling formats rather than the merits of the change. Given the mixed results of empirical studies and the over reliance on anecdotal claims, the overarching objective of this study is to assess differences in student outcomes between students in high schools using a block, semester, or trimester schedule in one urban school system over a four-year period. Specifically the study will test for differences in student annual grade point average, scores on the Stanford Achievement Test (SAT9), credits attempted and earned, and absentee rates.

Methods

Sample

The data used in this study are from a large urban school system with an enrollment of 28,000 students, of whom 60% are Caucasian, 24% are Hispanic, 6% Pacific Islander, 4% African American, 4% Asian, and 2% Native or Alaskan American. The fact that the schools in this study are from one district is a significant strength since it alleviates concerns regarding district effects in the study. All three traditional high schools were included in this study. Each school's schedule remained unchanged over the four years studied. Jefferson High School[1] used a trimester schedule enrolling 2,400 students per year, of whom 70% are white and 30% minority. Classes meet daily for 63 minutes per period, and there are five periods in a day.

Oakwood High School operated on a semester schedule enrolling 2,500 students per year, of whom 66% are white and 34% minority. There are seven periods that meet daily for 48 minutes. Washington High School utilized an A/B block schedule enrolling 2,400 students per year, of whom 63% are white and 37% minority. There are four classes daily, 83 minutes in length, and each class meets every other day. The grade structure of all three schools is 9-12.

Data Collection

Student level data for this investigation were drawn from the district's database maintained over four consecutive years, 1995-96 through 1998-99. The data set contained 28,526 individual records of students enrolled in any one of the three high schools during the 1995-99 school years.

Measures and Analysis

To compare student outcomes between schools with different schedules, descriptive and inferential statistics were utilized. Analysis of Covariance (ANCOVA) was the primary tool to test for mean differences between student outcomes. Dependent variables included annual grade point average, scores on the Stanford Achievement Test (SAT9), total credits attempted and earned, total core and elective credits attempted and earned, and absentee rates. The study controlled for student background variables including race/ethnicity, Limited English Proficiency (LEP), free/reduced lunch as an indicator of socioeconomic status (SES), gender, and special education. Table One reports percentages on student background variables by school and thus schedule type.

[Take in Table I Here]

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[1] Pseudonyms are used for each school in the study.

Results

Grade Point Average

ANCOVAs controlling for differences in the above student background variables revealed significant differences between the annual grade point averages of students in different schedules. Students within a semester schedule maintained a higher annual grade point average (Adj. M=2.35) than students on an A/B block (Adj. M=2.29) or trimester schedule (Adj. M=2.22), ($F=43.2$, $p<.000$, $R^2=.20$, η^2 or Eta Squared=.003). Furthermore, the adjusted mean GPA within the block schedule was significantly higher than adjusted mean GPA within the trimester schedule. Table Two at the end of the results section summarizes findings on all student outcomes assessed in this study.

In the district studied, all students are required to earn the same minimum number of credits to graduate. However, students in the block and trimester schedules have the opportunity to earn more credits each year than students under the semester schedule. Consequently, students in the semester schedule must pass a higher percentage of courses to graduate on time. This press to graduate is one possible explanation for higher GPAs under the semester schedule. Students on the block and trimester schedules can fail more courses, which would lower the average GPA, and still graduate on time.

Stanford Achievement Test (SAT9) Scores

Students within the semester schedule (Adj. M=717.8[2]) had higher SAT Total Math scores than students in the trimester (Adj. M=711.2) and A/B block (Adj. M=714.3), ($F=11.9$, $p<.000$, $R^2=.17$, $\eta^2=.005$). There was no significant difference between trimester and A/B block students' SAT Total Math scores. Students' SAT Science scores were found to be significantly

[2] Numbers are the mean scaled scores.

higher within both the trimester (Adj. M=692.7) and A/B block schedules (Adj. M=694.2) compared to the semester (Adj. M=689.4), ($F=8.6$, $p<.000$, $R^2=.17$, $\eta^2=.003$). No significant difference was present between the trimester and A/B block. Not surprisingly, math courses are significantly more sequential; therefore, students may benefit most by meeting day-to-day over shorter periods of time, which is the case in the semester schedule. Conversely, higher science scores might be predicted in block and trimester schedules, which have significantly longer class periods providing more opportunities for reinforcement through applied lab activities.

Course-Taking Patterns

Students' total credits attempted differed between schedules. Students on the trimester attempted an adjusted average of 6.33 credits per year, while students within the semester attempted an adjusted average of 6.14 credits, and those on an A/B block attempted an adjusted average of 6.23 ($F=34.0$, $p<.000$, $R^2=.02$, $\eta^2=.002$). These findings are not surprising since two trimesters (i.e., two thirds of an academic year) may count as one credit, while students attempting one credit in either the block or semester courses must enroll in two semesters lasting the entire year. Furthermore, differences between total credits attempted under the block and semester schedules are explained by the increased opportunities students have to attempt more credits on the block compared to the semester schedule. Of the total credits attempted, students earned 5.3 (84.1%) in the trimester, 5.2 (85.0%) in the semester, and 5.1 (82.3%) in the block schedule.

Disaggregating total credits attempted and earned by core and elective classes tells a more complete story. The only significant differences in core credits attempted were between semester (3.09) and A/B block (3.03). However, this is a relatively small difference. Students' similarity in core credits attempted may be explained by state and district graduation

requirements that apply equally across the three schools. However, students earned significantly fewer core credits in the A/B block compared to both the trimester and semester schedules, which is contradictory to the assumption that students who focus on fewer but longer classes complete those classes at higher rates.

Students on the trimester schedule attempted significantly more elective credits than those on the A/B block, who attempted significantly more electives than students on the semester schedule. In other words, although students attempt more credits under block and trimester schedules, they are not enrolling in more core courses. The difference is accounted for by an increased number of electives. Furthermore, students within the semester schedule earned significantly less elective credit than students within the trimester or block, reinforcing the limitation in the number of courses available during the year in a semester system. However, students on the semester schedule had the highest percentage of elective credits earned at 86.2%, while students on the block and trimester schedules earned 84.4% and 81.8%, respectively. Lower percentages of elective credits earned relative to credits attempted point to the possibility that students who have more opportunities to take elective courses may be more concerned with filling classes and less on passing them. In other words, because they can take more total credits but still need the same number of credits to graduate, they may be less motivated in some classes because they are able to graduate without completing them.

Attendance

The percent of total days absent within the semester (Mean=6.0%) and A/B block (Mean=5.6%) was significantly lower than students within the trimester (Mean=7.8%), ($F=65.8$, $p<.000$, $R^2=.06$, $\eta^2=.005$). Further exploration is necessary to determine what factors are accounting for the average of fifty more students absent each day under the trimester schedule.

Record-keeping is one possible explanation since the total number of classes varies between each of the schools.

[Take in Table II Here]

Conclusions

Although many findings in this study are statistically significant, collectively, the small effect sizes reinforce the weak relationship between structural change and changes in student outcomes. In other words, although the differences in this study were statistically significant, questions regarding their practical significance should be raised. As Elmore (1995) notes, educators believe structures constrain or enable their ability to serve students. Therefore, they are motivated to change them. On face value, such changes are easy to make and communicate symbolically that schools are invested in reform and improvement. However, precisely how these changes will result in improved student outcomes is much less clear. Elmore (1995) concludes "that the relationship between structural change in schools and changes in teaching and learning are mediated by relatively powerful factors such as the shared norms, knowledge, and skill of teachers..." (p.26).

Consistent with Elmore's claims and the findings of this study, the social psychological model of organizing (Weick, 1976) suggests that a school's normative structure is only loosely coupled with its behavioral structure. In short, structure may change without affecting behavior, and vice versa. Hence, school schedules may be altered without improving instructional practices and the school environment, leaving student outcomes relatively untouched. Educational organizations' loosely coupled nature contributes to the "productivity paradox"--investing resources in innovative, informational, and structural technologies without experiencing improved gains in student outcomes (Harris, 1994).

This study reaffirms the importance of educators thinking beyond structural changes. While structural changes may be necessary for student improvements, they are not sufficient. When changing day-to-day rituals such as the schedules, educators must also consider the necessity of curriculum and policy alignment, professional development, changes in power relationships, and normative changes regarding schooling.

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Table I

Covariates used in ANCOVAs and percentage within each schedule

Covariate	Trimester	Semester	A/B Block
Free/Reduced Lunch	37.4%	41.5%	40.3%
Gender			
Male	50.9%	54.7%	50.4%
Female	49.1%	45.3%	49.6%
Limited English Proficiency	6.6%	17.6%	9.1%
Race/Ethnic Minority	27.9%	29.7%	32.7%
Special Education	12.2%	9.3%	10.2%

Table II

Analysis of Covariances (ANCOVAs) for Student Outcomes

Source	**A/B Block** Adj. M	**Semester** Adj. M	**Trimester** Adj M	F	p	R^2	η^2
GPA	2.29	2.35	2.22	43.2	.000	.20	.003
SAT (scaled)							
Total Math	714.3	717.8	711.2	11.9	.000	.17	.005
Total Science	694.2	689.4	692.7	8.6	.000	.17	.003
Total Credits Attempted	6.2	6.1	6.3	34.0	.000	.02	.002
Total Credits Earned	5.1	5.2	5.3	11.9	.000	.11	.001
Core Credits Attempted	3.0	3.1	3.1	4.9	.008	.18	.001
Core Credits Earned	2.4	2.6	2.6	52.6	.000	.18	.003
Elective Credits Attempted	3.2	3.1	3.3	87.2	.000	.12	.005
Elective Credits Earned	2.7	2.6	2.7	14.4	.000	.08	.001
Total Days Absent (Mean)	5.6%	6.0%	7.8%	65.8	.000	.06	.005